A Literature Review of Early Intervention Treatment Methods in Young Children with Autism Spectrum Disorder

Reyes, Lauren K.

The Ohio State University

Abstract

The purpose of this study was to determine the level of evidence for interventions targeting communication in young children with a diagnosis on the autism spectrum (ASD) under six years of age. Many options are available to families seeking treatment for children with ASD (American Speech-Language-Hearing Association, 2006); some interventions have a higher evidence base than others. In this study, I rated the evidence of intervention articles published between 2008 and 2012 that targeted speech and language outcomes for children under the age of six. An online literature search for articles that met these criteria was completed using the databases Pub Med, Psych Info, and Google Scholar. Thirty-four articles were rated using the Reichow Scale (Reichow et. al. 2007) to determine the level of evidence. Reichow's scale considers the external scientific evidence. His practice for determining established and promising evidence-based practice (EBP) in this area for interventions requires multiple single subject and group experimental design studies to have been conducted on the intervention. Three interventions met the requirement for promising EBP, and two interventions met the requirement for established EBP. Additionally, many interventions showed strong research evidence. These findings indicate that more research must be conducted on the current interventions before determining whether or not they have high quality evidence and thus should be used clinically.

A Literature Review of Early Intervention Treatment Methods in Young Children with Autism Spectrum Disorder

I. Introduction

Autism Spectrum Disorder (ASD) is prevalent among children and adults everywhere. Approximately one in 88 children is affected by ASD in the United States (Center for Disease Control and Prevention, 2012). The term ASD refers to a group of disorders with overlapping characteristics. These disorders are autistic disorder, Rett's disorder, childhood disintegrative disorder, Asperger's disorder, and PDD-NOS. The common characteristics they all feature include challenges in social communication, language and related cognitive skills, behavioral and emotional regulation, and sensory and feeding issues. The individual's communication partner will often face challenges as well. American Speech-Language-Hearing Association, 2005; DSM-IV, 2000). Because a major feature of ASD is communication impairment, intervention aimed at improving speech and language skills are an essential part of intervention (DSM-IV, 2000).

Green (2006) conducted a study on what types of interventions families were pursuing for their children. She found that speech therapy was the most common intervention (69.9% of 552 families surveyed used speech therapy as part of an intervention). Given that speech and language is usually impaired in children diagnosed with ASD and that speech therapy is the most common type of intervention, speech-language pathologists play a crucial role in interventions.

There is an insufficient evidence base behind many of the treatments currently used (Green, 2006; McConaichie, 2007). As the awareness of ASD spreads, the number of treatments continues to increase (Goin-Kochel, 2007). With so many treatment options available, families may find it difficult to choose the best one, especially when these treatments lack scientific

evidence. Survey research on the types of interventions used by families with children diagnosed with ASD revealed that, on average, children were receiving between four and six treatments at a time. The survey also indicated that parents put in a lot of effort for the treatments (via parent participation, finances, and transportation) (Goin-Kochel, 2007). Thus, parents are investing their resources into treatments that may have little to no evidence base. Although parents often choose interventions with limited evidence, surveys collected from parents, teachers, and administrators revealed that most survey participants thought evidence-based practice (EBP) to be either "very important" or "absolutely important" in nearly all areas of social validity (Callahan, 2008). Callahan found that many invalidated interventions were being used throughout homes and schools; she noted that this is troubling given that EBP is important to the groups she surveyed. Callahan calls for further research to address social validity as an important part of successful education programs. Those who work closely with children diagnosed with ASD believe social validity to be an important aspect when choosing an effective treatment. Therefore, it is important for researchers to include social validity in their findings.

Two recent studies examined the state of intervention research. In an overview on five meta-analyses on early intensive behavioral intervention (EIBI) for children diagnosed with ASD, Reichow found that EIBI met criteria for one of the highest levels of evidence quality. However, in order to more fully understand the potential outcomes of EIBI Reichow calls for more specificity for research components and better knowledge about treatment outcomes (Reichow, 2011). In a 2009 study that reviewed interventions from 2001-2008, Reichow and Volkmar called for more descriptive participant characteristics, frequent measures of fidelity, blind raters to reduce bias, and large sample sizes (Reichow & Volkmar, 2009).

EBP does not rely on the opinions of experts; rather it contains specific criteria used to measure the quality of evidence. According to ASHA, there are five common subjects that contribute to evidence quality ratings: 1) Independent confirmation and converging evidence; 2) Experimental control; 3) Avoidance of subjectivity and bias; 4) Effect sizes and confidence intervals; and 5) Relevance and feasibility. EBP ensures that the research behind an intervention is of high quality ("Evidence-Based Practice in Communication Disorders: An Introduction," 2004).

The current research seeks to address the identified gaps by examining the existing evidence for interventions currently being used to address speech and language outcomes for young children with ASD. As noted previously, there are currently several types of early intervention treatments that target speech and language development for children with ASD. However, many treatment methods lack scientific evidence that they actually provide children and families with positive outcomes. The authors in the current research focus specifically on intervention methods targeted towards children with ASD under the age of six. The current research is a literature review of several early intervention practices.

Reichow et. al. (2007) examines the importance of EBP specifically in relation to autism interventions. In general, EBP is the use of research as evidence to support a method. In Reichow's research, the authors create a scale for determining the amount of evidence in an intervention method; it is known as the Reichow scale. The Reichow scale includes categories such as reliability, participant characteristics, fidelity and social validity. The Reichow scale exists for other researchers to examine the evidential support behind other published intervention methods. The authors of the current research use it to determine the amount of evidence in several intervention practices.

II. Methods

Description of Researchers and Their Training

Four undergraduate students studying speech and hearing science and one Ohio State faculty member served as the researchers for the current study. The faculty member trained the first author to code the articles for evidence quality based on the Reichow Scale. All four undergraduate researchers were taught how to search for research articles online

Search for Research Articles

The article search called for articles published between the years 2008 and 2012. The undergraduate researchers used the databases PubMed, Psych Info, and Google Scholar to search for articles. The terms "language," "autism," and "intervention" were used in the search; the researchers also limited the search to show results within the selected timeframe. Intervention studies focusing on language outcomes and included participants no older than six years of age were used in the review.

Rating Articles

The first author used the Reichow Scale comprised of 15 categories to objectively evaluate the articles for EBP. See Table 1 for more information on the 15 categories that were coded using the Reichow Scale. When the article met the criterion for a specific category, that category was given a score of one; when the article did not meet the criterion, that category was given a score of two; when the article did not mention that information category, that category was given a score of three. Consequently, lower scores indicated stronger EBP. An article that received a score of "1" on all criteria would receive a rating of 15; whereas one that received the worst possible score on each category would receive a 45.

Reliability

In order to measure reliability, the faculty author coded 10% of the articles that the undergraduate researcher had previously coded. Reliability was calculated as the percentage of agreement across articles. Raters had an agreement rating of 95% for the primary quality indicators (the first six categories) and 80% for the secondary quality indicators (the second nine categories). It should be noted that the disagreement on secondary indicators was due to lack of consensus on the social validity category scaling. Social validity was discussed by the first author and the faculty author, and the articles were recoded accordingly. When reliability was recalculated for secondary indicators after discussion, agreement was 93%.

III. Results

Thirty-four research articles were found that met the article search criteria. From these 34 articles, 24 different interventions were examined. The interventions examined were as follows: Augmented Communication Input (AC-I), Augmented Communication Output (AC-O), Spoken Communication (Romski, Sevcik, Adamson, Cheslock, Smith, Barker, Bakeman, 2010); Autism 1-2-3 (Wong & Kwan, 2009); Computer Assisted Instruction (CAI) - Teach Town: Basics (Whalen, Moss, Ilan, Vaupel, Fielding, Macdonald, Cernich, Symon, 2010); Joint Attention Intervention/Joint Attention Intervention and Symbolic Play Intervention (Kasari, Paparella, Freeman, Jahromi, 2008; Kasari, Gulsrud, Wong, Kwon, Locke, 2010; Kasari, Gulsrud, Freeman, Paparella, Hellemann, 2012; Kaale, Smith, Sponheim, 2012); Discrete Trial Teaching and Naturalistic Language Treatment (Landa, & Kalb, 2012); Early Start Denver Model (Rogers, Estes, Lord, Vismara, Winter, Fitzpatrick, Guo, Dawson, 2012; Vismara, Colombi, Rogers, 2009; Dawson, Rogers, Munson, Smith, Winter, Greenson, Donaldson, Varley, 2010); Enhanced

Milieu Teaching (EMT) (Kaiser & Roberts, 2012; Ingersoll, 2011); Focus Parent Training (Oosterling, Visser, Swinkels, Rommelse, Donders, Woudenberg, Roos, van der Gaag, Buitelaar, 2010); Hanen's 'More than Words' (Carter, Messinger, Stone, Celimli, Nahmias, Yoder, 2011); Home-Based Intervention (Rickards, Walstab, Wright-Rossi, Simpson, Reddihough, 2008); Interpersonal Synchrony (Landa, Holman, O'Neil, Stuart, 2011); Joint Attention Symbolic Play Engagement and Regulation (JASPER) (Goods, Ishijima, Chang, Kasari, 2012; Lawton & Kasari, 2012); LEAP Model of Early Intervention (Strain & Bovey, 2011); Milton and Ethel Harris Research Initiative (MEHRIT) (Casenhiser, Shanker, Stieben, 2011); Parent Education and Counseling, and Parent Education and Behavior Management (Tonge, Brereton, Kiomall, Mackinnon, Rinehart, 2012); Picture Exchange Communication System (PECS) (Yoder & Lieberman, 2009; McDuffie & Yoder, 2010); Preschool Autism Communication Trial (PACT) (Green, Charman, McConachie, Aldred, Slonims, Howlin, LeCouteur, Leadbitter, Hudry, Byford, Barrett, Temple, Macdonald, Pickles, PACT Consortium, 2010); Rapid Motor Imitation Antecedent (Paul, Campbell, Gilbert, Tsiouri, (2012); Reciprocal Imitation Training (RIT)/Reciprocal Imitation Training and Video Modeling (Ingersoll 2010; Cardon & Wilcox, 2011); Advanced Social-Communication and Play (ASAP) (Dykstra, Boyd, Watson, Crais, Baranek, 2011); ABAB Design (Koegel, Vernon, Koegel, 2009); Treatment and Education of Autistic and Related Communication Handicapped Children and Pivotal Response Training (Landa & Kalb, 2012); and Focused Playtime Intervention (Siller, Hutman, Sigman, 2012).

Quality Ratings for Individual Articles

The average total quality rating received by the studies was 21.29 with a mode score of 22. Of the 34 articles rated, 19 scored between 19 and 23. A group research study received a quality rating of "strong" when all the primary quality indicators received a rating of one and

four or more of the second quality indicators (see Table 3) received rating of one. A group research study received a quality rating of "adequate" when four or more primary indicators received a rating of one (with no ratings of three) and at least two secondary indicators had ratings of one. A quality rating of "weak" was given when the group research design received anything less than an adequate rating.

A single subject design study received a quality rating of "strong" when all the primary quality indicators received a rating of one and three or more of the second quality indicators received rating of one. A single subject design study received a quality rating of "adequate" when four or more primary indicators received a rating of one (with no ratings of three) and at least two secondary indicators had ratings of one. A quality rating of "weak" was given when the single subject research design received anything less than an adequate rating.

Twelve studies earned strong quality ratings, 20 studies earned adequate quality ratings, and two studies earned weak quality ratings.

Ratings of Individual Treatments: Established vs. Promising EBP

According to Reichow, treatments must meet at least one of the following criteria to qualify for established EBP: at least five single subject studies indicating strong research; at least ten single subject studies indicating adequate research; at least two group experimental design studies strong research (separate research teams) indicating strong research; at least four group experimental design studies (at least two separate research teams) indicating adequate research; one experimental design study and three single subject design studies indicating strong research; two experimental design studies indicating adequate research and three single subject design studies indicating strong research; one experimental design study indicating strong research and

six single subject design studies indicating adequate research; two group experimental design studies and six single subject design studies indicating adequate research.

Reichow's criteria for meeting promising EBP calls for the study to have an adequate research report in at least three single subject studies (conducted by at least two different teams, conducted in at least two different locations, with a total sample size of at least nine different participants across studies) or an adequate research quality rating in at least two group experimental design studies (Reichow et. al. 2007).

Two interventions met criteria for established EBP and three interventions met criteria for promising EBP. The Early Start Denver Model (ESDM) and Joint Attention Interventions qualified for established EBP, while Reciprocal Imitation Training (RIT), Milieu Teaching, and Picture Exchange Communication System (PECS) qualified for promising EBP.

IV. Discussion

When using the Reichow Scale as a measurement of study quality, twelve studies earned a strong quality rating, 20 studies earned an adequate quality rating, and two earned a weak quality rating. Most articles scored quality ratings between 19 and 23, though the average quality rating was 21.29. When following the Reichow Scale's recommendations regarding intervention evidence, two interventions qualified for established EBP and three interventions qualified for promising EBP. Although not all the interventions qualified for established or promising EBP, their quality ratings indicate that with more research they are likely to qualify for established or promising EBP in the future.

Although only five qualified for promising or established EBP, there is improvement when compared to the results found in Reichow (2009). The quality ratings of research have

shown an increase in the past five years; eight studies in Reichow (2009) earned strong quality ratings, the other 27 earned adequate quality ratings. Additionally, of the 34 articles examined by Reichow (2009), only four were group design studies. Conversely, a search of the literature yielded 24 group design studies to examine. Given that randomized control trials are considered the strongest level of evidence (Cochrane Consumer Network, 2012), the noted increase of group design studies, especially randomized control trials, provides researchers and clinicians with stronger evidence for interventions. Reichow (2009) called for more descriptive participant characteristics, frequent measures of fidelity, blind raters, and large sample sizes. Of the studies reviewed, more included these aspects of research than the studies examined in Reichow (2009).

Green (2006) found that the most widely used treatments, as determined by the researchers' survey, had varying degrees of evidence. In looking at the studies examined for the current review, there is improvement as most of the studies showed adequate or strong quality ratings for evidence; only two studies earned a quality rating of weak. Of the five interventions qualifying for established or promising EBP in the present study, only two were reportedly being used in practice in Green (2006): PECS and Joint Attention. Of the sample from the study, 27.6% of parents had been currently using PECS, and 31.1% had used it in the past. Joint Action Routines were being used by 2.2% of parents at the time the study was conducted, and 5.9% had used it in the past. Similarly, in Goin-Kochel (2007), which studied the frequency and types of treatments used for children diagnosed with ASD, PECS was the only intervention of the five that was reportedly being used by parents of children diagnosed with ASD. Sixty-eight percent of parents had used PECS in the past and 48.1% were using it at the time of the study. This information proves that PECS has been one of the most popular interventions over the past few years.

Although the current state of research has improved in the past few years, there are still aspects of research that need to be more consistently reported. Effect sizes were reported in most of the studies, yet they were often reported in different units. Cohen's "d" was the most widely, used and it is also the unit the first author coded for when rating the articles. Cohen's "d" must be used more consistently in order for parents, teachers, and clinicians to understand how great of an effect size was achieved. Additionally, many articles did not conduct follow-up assessments. In order to prove that outcomes were long lasting in children, data must be collected a significant amount of time after the intervention was completed. Furthermore, a full description of the interventionists in addition to the participants must be included in the study. This information aids in the understanding of the intervention. Finally, fidelity must be taken and reported for all who implement the intervention (parents, teachers, clinicians, etc.). When fidelity is not reported it becomes difficult to determine whether the outcomes are a result of the intervention itself or individual variation of the intervention.

Limitations

The first limitation of this study is that it only focused on interventions solely for young children under the age of six. This limited the amount of data that could be collected on recently published intervention studies because many interventions are targeted towards both young children and school-age children.

Another limitation is that the study only focused on a five-year period. Although none of the interventions qualified for promising or established EBP in this study, had the authors been able to review older studies published on those same interventions it is possible that some of the interventions would have then qualified for promising or established EBP.

V. Conclusion

Even though only five of the interventions studied within the timeframe met criteria for promising or established EBP, they showed high quality ratings. This indicates that researchers are gaining an understanding of the importance of evidence quality and want published research to reflect it. With the rise of ASD awareness comes more treatment options available to families. Previously, many interventions contained claims from parents and teachers that the interventions yielded tremendous outcomes, yet the interventions did not contain much scientific evidence showing these outcomes. Now, the importance of evidence quality is spreading among researchers, teachers, and parents. Therefore, recently published studies are focusing more on providing the evidence that the intervention provides positive outcomes. Although more research (both single subject and group studies) needs to be conducted to ensure that these interventions meet the criteria high quality evidence, many of the interventions reviewed in this study are on their way to being the leading treatment options for young children diagnosed with ASD.

References

American Speech-Language-Hearing Association. (2006). *Principles for speech-language pathologists in diagnosis, assessment, and treatment of autism spectrum disorders across the life span* [Technical Report]. Available from www.asha.org/policy. DOI:10.1044/policy.TR2006-00143

American Speech-Language-Hearing Association. (2004). *Evidence-based practice in communication disorders: an introduction* [Technical Report]. Available from www.asha.org/policy. DOI:10.1044/policy.TR2004-00001

Callahan, K.; Henson, R.; Cowan, A. (2007). Social Validation of Evidence-Based Practices in Autism by Parents, Teachers, and Administrators. *Journal of Autism and Developmental Disorders*, 38, 678-692. DOI: 10.1007/s10803-007-0434-9.

Cardon, T. A., & Wilcox, M. J. (2011). Promoting imitation in young children with autism: A comparison of reciprocal imitation training and video modeling. *Journal of Autism and Developmental Disorders, 41,* 654-666. DOI: 10.1007/s10803-010-1086-8.

Carter, A. S., Messinger, D. S., Stone, W. L., Celimli, S., Nahmias, A. S., & Yoder, P. (2011). A randomized controlled trial of Hanen's 'More Than Words' in toddlers with early autism symptoms. *Journal of Child Psychology and Psychiatry, 52,* 741-752. DOI: 10.1111/j.1469-7610.2011.02395.x.

Casenhiser, D. M., Shanker, S. G., & Stieben, J. (2011). Learning through interaction in children with autism: Preliminary data from a social-communication-based intervention. *Autism, 0,* 1-22. DOI: 10.1177/1362361311422052.

Cochrane Consumer Network. (2012) *Levels of Evidence.* Available from http://consumers.cochrane.org/levels-evidence

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., Donaldson, A., & Varley, J. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The early start Denver model. *Pediatrics Office Journal of the American Academy of Pediatrics, 125,* 17-23. DOI: 10.1542/peds.2009-0958.

Dykstra, J. R., Boyd, B. A., Watson, L. R., Crais, E. R., & Baranek, G. T. (2011). The impact of the Advancing Social-communication and Play (ASAP) intervention on preschoolers with autism spectrum disorder. *Autism, 16,* 27-44. DOI: 10.1177/1362361311408933.

Fernell, E., Hedvall, A., Westerlund, J., Carlsson, L. H., Eriksson, M., Olsson, M. B., Holm, A., Norrelgen, F., Kjellmer, L., & Gillberg, C. (2011). Early intervention in 208 Swedish preschoolers with autism spectrum disorder. A prospective naturalism study. *Research in Developmental Disabilities, 32,* 2092-2101. DOI: 10.1016/j.ridd.2011.08.002.

Goods, K. S., Ishijima, E., Chang, Y., & Kasari, C. (2012). Preschool based JASPER intervention in minimally verbal children with autism: Pilot RCT. *Journal of Autism and Developmental Disorders* DOI: 10.1007/s10803-012-1644-3.

Green, J., Charman, T., McConachie, H., Aldred, A., Slonims, V., Howlin, P., LeCouteur, A., Leadbitter, K., Hudry, K., Byford, S., Barrett, B., Temple, K., Macdonald, W., Pickles, A., & PACT Consortium. (2010). Parent-mediated communication-focused treatment in children with autism (PACT): A randomized controlled trial. *The Lancet Journal, 375,* 2152-2160. DOI: 10.1016/S0140-6736(10)60587-9.

Green, V., Pituch, K., Itchon, J., Choi, A., O'Reilly, M., Sigafoos, J. (2004). Internet Survey of Treatments used by Parents of Children with Autism. *Research in Developmental Disabilities*, 27, 70-84. DOI: 10.1016/j.ridd.2004.12.002

Goin-Kochel, R., Myers, B., Mackintosh, V. (2007). Parental Reports on the use of Treatments and Therapies for Children with Autism Spectrum Disorders. *Research in Autism Spectrum Disorders*, 195-209. DOI:10.1016/j.rasd.2006.08.006

Goldstein, H. (2002). Communication Intervention for Children with Autism: A Review of Treatment Efficacy. Journal of Autism and Developmental Disorders, 32. 0162-3257/02/1000-0373/0

Ingersoll, B. (2008). The social role of imitation in autism: Implications for the treatment of imitation deficits. Infants & Young Children, 21, 107–119. DOI: 10.1097/01.IYC.0000314482.24087.14.

Ingersoll, B. (2011). The differential effect of three naturalistic language interventions on language use in children with autism. *Journal of Positive Behavior Interventions, 13,* 109-118. DOI: 10.1177/1098300710384507.

Ingersoll, B., & Lalonde, K. (2010). The impact of object and gesture imitation training on language use in children with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research, 53,* 1040-1051. DOI: 10.1044/1092-4388(2009/09-0043).

Kaale, A., Smith, L., & Sponheim, E. (2012). A randomized controlled trial of preschool-based joint attention intervention for children with autism. *Journal of Child Psychology and Psychiatry, 53,* 97-105. DOI: 10.1111/j.1469-7610.2011.02450.x.

Kaiser, A. P., & Roberts, M. Y. (2012). Parent-implemented enhanced milieu teaching with preschool children with intellectual disabilities. *Journal of Speech Language and Hearing Research,* 56, 295-309. DOI: 10.1044/1092-4388(2012/11-0231).

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders, 40,* 1045-1046. DOI: 10.1007/s10803-010-0955-5.

Kasari, C., Gulsrud, A., Freeman, S., Paparella, T., & Hellemann, G. (2012). Longitudinal follow-up of children with autism receiving targeted interventions on joint attention and play. *Journal of American Academy of Child and Adolescent Psychiatry, 51,* 487-495**.** DOI: 10.1016/j.jaac.2012.02.019

Kasari, C., Paparella, T., Freeman, S., & Jahromi L. B. (2008). Language outcome in autism: Randomized comparison of joint attention and play interventions. *Journal of Consulting and Clinical Psychology, 76*, 125-137. DOI: 10.1037/0022-006X.76.1.125.

Koegel, R. L., Vernon, T. W., & Koegel, L. K. (2009). Improving social initiations in young children with autism using reinforcers with embedded social interactions. *Journal of Autism and Developmental Disorders, 39,* 1240-1251. DOI: 10.1007/s10803-009-0732-5.

Landa, R. J., & Kalb, L. G. (2012). Long-term outcomes of toddlers with autism spectrum disorders exposed to short-term intervention. *Pediatrics Office Journal of the American Academy of Pediatrics, 130,* S186-S190. DOI: 10.1542/peds.2012-0900Q.

Landa, R. J., Holman, K. C., O'Neill, A. H., & Stuart, E. A. (2011). Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: A randomized controlled trial. *Journal of Child Psychology and Psychiatry, 52,* 13-21. DOI: 10.1111/j.1469-7610.2010.02288.x.

Lawton, K., & Kasari, C. (2012). Teacher-implemented joint attention intervention: Pilot randomized controlled study for preschoolers with autism. *Journal of Consulting and Clinical Psychology, 80,* 687-693. DOI: 10.1037/a0028506.

McConachie, H.; Diggle, T. (2006). Parent Implemented Early Intervention for Young Children with Autism Spectrum Disorder: A Systematic Review. *Journal of Evaluation in Clinical Practice*, 13, 120-129. ISSN 1356-1294.

McDuffie, A., & Yoder, P. (2010). Types of parent verbal responsiveness that predict language in young children with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research, 53,* 1026-1039. DOI: 10.1044/1092-4388(2009/09-0023).

Oosterling, I., Visser, J., Swinkels, S., Rommelse, N., Donders, R., Woudenberg, T., Roos, S., Jan van der Gaag, R., & Buitelaar, J. (2010). Randomized controlled trial of the focus parent training for toddlers with autism: 1-Year outcome. *Journal of Autism and Developmental Disorders, 40,* 1447-1458. DOI: 10.1007/s10803-010-1004-0.

Paul, R., Campbell, D., Gilbert, K., & Tsiouri, I. (2012). Comparing spoken language treatments for minimally verbal preschoolers with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 43,* 418-431. DOI: 10.1007/s10803-012-1583-z.

Reichow, B. (2011). Overview of Meta-Analyses on Early Intensive Behavioral Intervention for Young Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*. DOI 10.1007/s10803-011-1218-9

Reichow, B.; Volkmar, F. (2009). Social Skills Interventions for Individuals with Autism: Evaluation for Evidence-Based Practices within a Best Evidence Synthesis Framework. *Journal of Autism and Developmental Disorders,* 40, 149-166. DOI: 10.1007/s10803-009-0842-0

Reichow, B.; Volkmar, F.; Cicchetti, V. (2007). Development of the Evaluative Method for Evaluating and Determining Evidence-Based Practices in Autism. *Journal of Autism and Developmental Disorders*, 38, 1311-1319. DOI: 10.1007/s10803-007-0517-7

Rickards, A. L., Walstab, J. E., Wright-Rossi, R. A., Simpson, J., & Reddihough, D. S. (2008). One-year follow-up of the outcome of a randomized controlled trial of a home-based intervention programme for children with autism and developmental delay and their families. *Child: care, health and development, 35,* 593-602. DOI: 10.1111/j.1365-2214.2009.00953.x.

Rogers, S. J., Estes, A., Lord, C., Vismara, L., Winter, J., Fitzpatrick, A., Guo, M., & Dawson, G. (2012). Effects of a brief Early Start Denver Model (ESDM) – Based parent intervention on toddlers at risk for autism spectrum disorders: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 51,* 1052-1064. DOI: 10.1016/j.jaac.2012.08.003.

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech, Language, and Hearing Research, 53,* 350-364. DOI: 10.1044/1092-4388(2009/08-0156).

Siller, M., Hutman, T., Sigman, M. (2012). A Parent-Mediated Intervention to Increase Parental Responsive Behaviors and Child Communication in Children with ASD: A Randomized Clinical Trial. *Journal of Autism Developmental Disorders.* DOI 10.1007/s10803-012-1584-y

Siller, M., & Sigman, M. (2008). Modeling longitudinal change in the language abilities of children with autism: Parent behaviors and child characteristics as predictors of change. *Developmental Psychology, 44,* 1691-1704. DOI: 10.1037/a0013771.

Strain, P. S., & Bovey II, E. H. (2011). Randomized, controlled trial of the LEAP model of early intervention for young children with autism spectrum disorders. *Topics in Early Childhood Special Education, 31,* 133-154. DOI: 10.1177/0271121411408740.

Tonge, B., Brereton, A., Kiomall, M., Mackinnon, A., & Rinehart, N. J. (2012). A randomised group comparison controlled trial of 'preschoolers with autism': A parent education and skills training intervention for young children with autistic disorder. *Autism, 0,* 1-18. DOI: 10.1177/1362361312458186.

Vismara, L. A., Colombi, C., & Rogers, S. J. (2009). Can one hour per week of therapy lead to lasting changes in young children with autism. *Autism, 13,* 93-115. DOI: 10.1177/1362361307098516.

Whalen, C., Moss, D., Ilan, A. B., Vaupel, M., Fielding, P., Macdonald, K., Cernich, S., & Symon, J. (2010). Efficacy of teachtown: Basics computer-assisted intervention for the intensive comprehensive autism program in Los Angeles unified school district. *Autism, 14,* 179-197. DOI: 10.1177/1362361310363282.

Wong, V. C. N., & Kwan, Q. K. (2009). Randomized controlled trial for early intervention for autism: A pilot study of the autism 1-2-3 project. *Journal of Autism and Developmental Disorders, 40,* 677-688. DOI: 10.1007/s10803-009-0916-z.

Yoder, P. J., & Lieberman, R. G. (2009). Brief report: Randomized test of the efficacy of picture exchange communication system on highly generalized picture exchanges in children

with ASD. *Journal of Autism and Developmental Disorders, 40,* 629-632. DOI: 10.1007/s10803-009-0897-y.

Zachor, D. A., & Itzchak, E. B. (2010). Treatment approach, autism severity and intervention outcomes in young children. *Research in Autism Spectrum Disorders, 4,* 425-432. DOI: 10.1016/j.rasd.2009.10.013.

Appendix

Table 1

Categories and Descriptions of Reichow Scale

Subject	Description
Primary Quality Indicators	
Description of Children	Age, Gender, Diagnostic Info, Standardized Test Scores
Description of Children and Interventionist	Age, Gender, Diagnostic Info, Standardized Test Scores, Characteristics of Interventionists
Information about Intervention Method	Enough information that rater can repeat the study
Information about Comparison Condition	Description of treatment of the control group
Information about Outcome Variable	Replicable precision, clear link to treatment outcome, data collected at appropriate times
Link Between Data Analyses and Treatment Question	Yes/No
Secondary Quality Indicators	
Proper Sample Size	Greater than 10
Randomization	Participants randomly assigned to conditions
Interobserver Agreement	Above .80 (percent agreement); Minimum 0.60 for Kappa
Blind Coding	Coders did not know to which treatment group the children belonged
Treatment Fidelity	Someone watched interventionist during treatment to ensure it was being done correctly (At least 80%)
Similar Drop Out Rate	Nearly equal drop out rate; Less than 30% of final sample size
Exit Assessments	Outcome measures collected one more time after the intervention concluded
Reported Effect Size	For more than 75% of the outcome measures used; Number is at least 0.40
Social Validity	(At least 4 of 7): 1) DV Socially important; 2) Time and cost effective; 3) Comparisons between individuals with and without disability; 4) Clinically significant behavioral changes; 5) Consumers satisfied with results; 6) People who typically come into contact with part manipulated the IVs; 7) Occurred in Natural Contexts

Table 2

Interventions Reviewed

Intervention	Author
Augmented Communication Input (AC-I), Augmented Communication Output (AC-O), Spoken Communication	Romski, Sevcik, Adamson, Cheslock, Smith, Barker, & Bakeman (2010)
Autism 1-2-3	Wong & Kwan (2009)
Computer Assisted Instruction (CAI) - Teach Town: Basics	Whalen, Moss, Ilan, Vaupel, Fielding, Macdonald, Cernich, & Symon (2010)
Joint Attention/Joint Attention and Symbolic Play (n = 4)	Kasari, Gulsrud, Freeman, Paparella, & Hellemann (2012)
	Kasari, Paparella, Freeman, & Jahromi (2008)
	Kasari, Gulsrud, Wong, Kwon, & Locke (2010)
	Kaale, Smith, & Sponheim (2012)
Early Start Denver Model (n = 3)	Rogers, Estes, Lord, Vismara, Winter, Fitzpatrick, Guo, & Dawson (2012)
	Vismara, Colombi, & Rogers (2009)
	Dawson, Rogers, Munson, Smith, Winter, Greenson, Donaldson, & Varley (2010)
Milieu Teaching/Enhanced Milieu Teaching (n = 2)	Kaiser & Roberts (2012)
	Ingersoll (2011)
Focus Parent Training	Oosterling, Visser, Swinkels, Rommelse, Donders, Woudenberg, Roos, van der Gaag, & Buitelaar (2010)
Hanen's 'More than Words'	Carter, Messinger, Stone, Celimli, Nahmias, &Yoder (2011)
Home-Based Intervention	Rickards, Walstab, Wright-Rossi, Simpson, & Reddihough (2008)
Interpersonal Synchrony	Landa, Holman, O'Neil, & Stuart (2011)
Focused Playtime Intervention	Siller, Hutman, & Sigman (2012)
JASPER (Joint Attention Symbolic Play Engagement and Regulation)	Goods, Ishijima, Chang, & Kasari (2012)
	Lawton & Kasari (2012)
LEAP Model of Early Intervention	Strain & Bovey (2011)
Milton & Ethel Harris Research Initiative (MEHRIT)	Casenhiser, Shanker, & Stieben (2011)
Parent Education and Counseling, and Parent Education and Behavior Management	Tonge, Brereton, Kiomall, Mackinnon, & Rinehart (2012)
PECS/PECS and RMPT (n = 2)	Yoder & Lieberman (2009)
	McDuffie & Yoder (2010)
Preschool Autism Communication Trial (PACT)	Green, Charman, McConachie, Aldred, Slonims, Howlin, LeCouteur, Leadbitter, Hudry, Byford, Barrett, Temple, Macdonald, Pickles, & PACT Consortium (2010)
Rapid Motor Imitation Antecedent	Paul, Campbell, Gilbert, & Tsiouri (2012)

Reciprocal Imitation Training	Ingersoll (2010)
(RIT)/Reciprocal Imitation Training and Video Modeling (n = 2)	Cardon & Wilcox (2011)
Advancing Social-communication And Play (ASAP)	Dykstra, Boyd, Watson, Crais, & Baranek (2011)
ABAB design	Koegel, Vernon, Koegel (2009)
Treatment and Education of Autistic and Related Communication Handicapped Children, Pivotal Response Training, Discrete Trail Training (and ABA, routine-based responsive teaching strategies, and visual cues)	Landa & Kalb (2012)
Intervention not specifically named	Ingersoll (2008)
Intervention not specifically named	Siller (2008)
Applied Behavior Analysis (ABA) and Eclectic Community Center-Based Programs	Zachor (2009)

Table 3

Secondary and Primary Scores

Article	Primary	Secondary	Research Strength
Kasari et al. (2010)	6	9	Strong
Kaale et al. (2012)	6	11	Strong
Carter et al. (2011)	6	11	Strong
Rickards et al. (2008)	6	16	Strong
Paul et al. (2012)	6	11	Strong
Siller et al. (2012)	8	10	Strong
Kasari et al. (2008)	6	12	Strong
Kaiser & Roberts (2012)	6	13	Strong
Oosterling et al. (2010)	6	15	Strong
Ingersoll (2010)	6	13	Strong
Dawson et al. (2010)	6	14	Strong
Rogers et al. (2012)	6	14	Strong
Ingersoll (2011)	6	16	Adequate
Cardon & Wilcox (2011)	8	13	Adequate
Lawton & Kasari (2012)	10	11	Adequate
Tonge et al. (2012)	8	14	Adequate
Koegel et al. (2009)	8	14	Adequate
Green et al. (2010)	7	12	Adequate
Strain & Bovey (2011)	10	12	Adequate
Landa & Kalb (2012)	9	13	Adequate
Zachor (2010)	6	16	Adequate
Wong & Kwon (2009)	6	17	Adequate
Casenhiser et al. (2011)	9	10	Adequate
McDuffie & Yoder (2010)	7	17	Adequate
Ingersoll (2008)	8	16	Adequate
Romski et al. (2010)	10	14	Adequate
Kasari et al. (2012)	10	14	Adequate
Whalen et al. (2010)	10	15	Adequate
Yoder & Lieberman (2009)	10	15	Adequate

Siller (2008)	10	15	Adequate
Landa et al. (2011)	8	9	Adequate
Dykstra et al. (2011)	8	18	Adequate
Goods et al. (2012)	11	12	Weak
Vismara et al. (2009)	12	14	Weak

Note. Strong indicates a rating of one on all primary indicators and a rating of one on four or more of the secondary indicators for group research. Single subject design studies received a strong quality rating when all the primary quality indicators received a rating of one and three or more of the secondary indicators received rating of one. An adequate quality indicator was earned when four or more primary indicators received a rating of one (with no ratings of three) and at least two secondary indicators had ratings of one for group research. Single subject design studies earned an adequate rating when four or more primary indicators received a rating of one (with no ratings of three) and at least two secondary indicators had ratings of one. A study earned a weak rating when it did not meet criteria for an adequate rating.